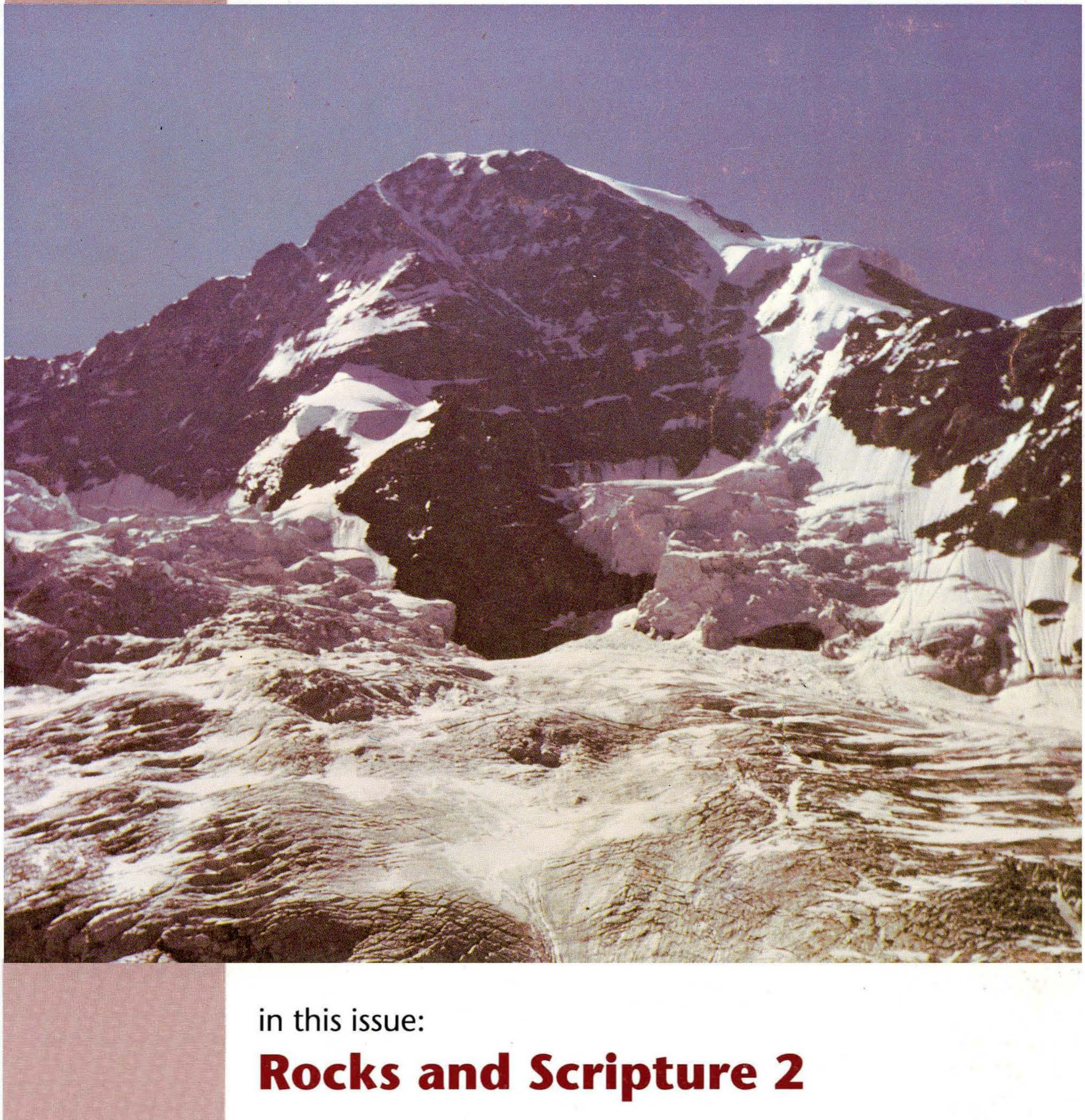
ORIGINS

• Journal of the Biblical Creation Society •

Volume 3 Number 9



in this issue:

Rocks and Scripture 2

Pre-Flood Limestone Deposition

The Decay in the Speed of Light

ORIGINS
• Journal of the Biblical Creation Society •

Vol 3 No 9
July 1990

Contents

		Page
Editorial	Peter Senior	2
Creation in the News		3
Rocks and Scripture: Investigating the Earth's History	Michael Garton	4
Pre-Flood Limestone Deposition	Daniel Wonderly	10
The Decay in the Velocity of Light: Real or Imaginary?	John Peet	16
Reviews:		
The God who is Real	Bob Robinson	19
The Great Divide	John Tindall	20
Correspondence		20
News of Creation		21

Editorial Committee

General Editor Michael G. Matthews BArch MSc RIBA Architect & Systems Manager in Chester
Technical Editor David C. Watts PhD BSc CPhys FInstP CChem FRSC Senior Lecturer in Biomaterials Science, University of Manchester
Review Editor Nancy M. Darrall PhD Research Officer with National Power Technology & Environmental Centre in Leatherhead
Advertising Editor Peter Senior BSc MInstP CPhys Research Associate at the University of Technology, Loughborough
The Revd Nigel M. de S. Cameron MA BD PhD Warden of Rutherford House, Edinburgh
J.H. John Peet PhD CChem FRSC Science Co-ordinator at Guildford College of Technology
David J. Tyler MSc MInstP CPhys ACFI Senior Lecturer at Manchester Polytechnic

Writing for Origins

Origins is looking for talented new writers, particularly those who have had experience in a specialised field of science or theology, in relation to creation, and who are in agreement with the aims and basis of the BCS. In addition writers in a popular vein are needed, but accuracy and solid content are still essential. Any manuscripts for consideration should ideally be typed, double-spaced and sent to the Editor. News items that may be of interest are also sought. We are now also able to receive manuscripts submitted on disk, Amstrad 3" format; disks would be returned after transfer of the file.

Editorial Policy

Whilst **Origins** exists to further the aims of the Biblical Creation Society, opinions expressed in articles and signed editorials are not necessarily shared by either the Editorial Committee or the Society.

Credits

Design and artwork by Carroll & Gold Design, 72 Whitley Wood Lane, Reading, Berks. RG2 8PP
Telephone: (0734) 313121 Fax: (0734) 756083

ORIGINS 3:9
• Journal of the Biblical Creation Society •

Editorial

A lesson that has to be learned by all creationists is that there are subtle implications to the doctrine that "... faith is being sure of what we hope for and certain of what we do not see. This is what the ancients were commended for." (Hebrews 11;1,2)

It is tempting, as a young believer, to search after the final rigorous scientific proofs for Creation and the Flood, with its implications to the need of a Saviour. But why should the tiny minority of the world's population that have been educated to appreciate such ways of thinking, be favoured above all others, when it comes to realising their need? The scientist is still spiritually blind from birth, like the rest of us. But when the atheist claims that his science has a monopoly on truth, and that the Bible is clearly wrong, then the creationist must reply, as Scripture instructs: "Always be prepared to give an answer to everyone who asks you to give the reason for the hope that you have." (1 Peter 3:15)

If the Holy Spirit is at work in the heart of an unbeliever, this may well be a step on his journey to salvation. Or if a believer has spent so much time reading the words of men, that their philosophy has made him doubt the Word of God, then let us pray that our witness will lead him back to firm ground, on matters such as reason and faith.

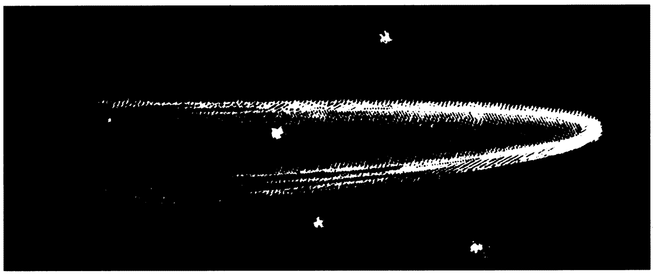
The Speed of Light

The news of Barry Setterfield's work on apparent decay in the speed of light broke upon the world of creation science in 1983. His inspiration was the lively debate that appeared in scientific journals, between 1924 and 1944. A British physicist, M.E.J. Gheury de Bray, had found errors in standard texts that referred to historical measurements of the speed of light, delved into the original papers, and published a list of values in 'Nature' in 1927. A.A. Michelson was in the unique position of having made such measurements in 1879, 1924 and 1926. He also felt that his results showed a decline.

Much of the discussion did not touch on the empirical results, but mainly on the theoretical reasons as to why they could not possibly be correct. However, fundamental discoveries are usually made when repeated experiment shows up the limits of a theory. As is usual though with hard evidence, it did soften under close scrutiny. In 1944, N.E. Dorsey of the American Bureau of Standards wrote the following about Michelson's work:

"Not one of his reports contains sufficient detailed information to enable a reader to form an independent and objective evaluation of the result. Whatever value he may attach to it is purely subjective, resting solely on his confidence in Michelson."

Every valid criticism of a man's work however, gives him a chance to improve it. Barry Setterfield has laboured long and hard on the apparent variation in the speed of light, and the cosmological consequences that this would have. If indeed he is correct, the Lord will enable him to answer his critics. However, John Peet has made a thorough study of his work, and it does seem that Barry may join the ranks of other scientists (including the present writer), who have at some time in their career, seen something in the data that wasn't really there. As a companion article, dealing with the early secular debate, I recommend that by Peter Ohrstrom in Ex Nihilo Technical Journal, Vol. 3, 1988, pp 155-159.



Rocks and Scripture 2

When discussing rock strata and historical geology it is difficult to pick out pure data that has not had a layer or two of interpretation laid on top. Even before reporting upon findings, one's previous ideas tend to dictate which observations are made, and which are thought irrelevant. During our Cloverly Hall deliberations, David Tyler related an incident in which he was able to get a British Coal geologist to look a little closer at some 'seat earth' beneath a coal stratum, and see for the first time that there were features present that challenged his beliefs as to coal formation.

On the other hand, Michael Garton helps us consider whether some creationists, in challenging the geological column over the years, have perhaps gone too far in rejecting the sequences of rocks. Our real argument being with the idea of a slow uniformitarian rate of deposition, as opposed to rapid catastrophism, on possibly more than one occasion, and varying scales.

Preflood limestones

When vast limestone strata are found throughout the world, that would seem to require many generations of carbonate-secreting organisms to produce them, it is a serious challenge to any theories of a young Earth, which would produce all their fossils in a single worldwide flood.

Petroleum geologists also find rigid apartheid in the strata, between organisms that live together, and perhaps more importantly, are found dead together, in today's sediments. When these simple organisms cannot be sorted by density and therefore flotation, the maintenance of their separation during the violence of the Genesis Flood cannot at present be explained.

Thus it is that Daniel Wonderly presents in his paper these and other evidences of a vintage for our planet that might make some of us uncomfortable. Yet it must be clearly stated here, as it is in his article, that he finds no evidence for biological evolution, and believes that the Flood in Noah's day left alive only those human beings in the Ark.

Creation in the News

Earliest Primates Fall Out of Family Tree. (Despite being able to 'fly'!)

New Scientist No. 1722, 23 June 1990, pp 57-60.

Pat Shipman, a freelance science writer, wrote the above article, but preferred to call it 'Primate Origins Up in the Air Again'. It summarises the findings of two papers that appeared in the 24 May issue of 'Nature.'

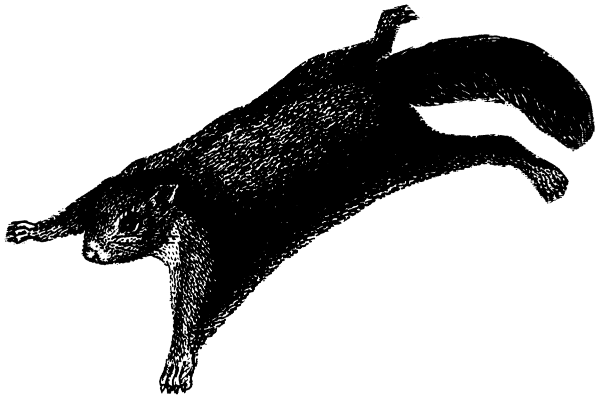
The story so far

Up to 1973 it was said that the survival skills and traits needed for living in trees shaped the evolution of primates. In that year Matt Cartmill pointed out that the same pressures had not produced major primate characteristics in squirrels. The extra elements he added were hunting at night, towards the ends of small branches, using hand-eye coordination to grab insects.

Unfortunately this added requirements about improved vision and a less-used sense of smell, which eliminated the skulls of nearly all the earliest species classified as primates (in the Palaeocene, 54-65 million years ago). But paleontologists wanted to keep them, as their jaws and teeth were similar to those of undoubted primates in the later Eocene strata (38-54 million years ago, if such dates are to be believed). They thought that, when more complete skeletons were found, it would settle the issue.

Some modern tree-dwellers

The flying lemurs or colugos of today, have a web of skin between arms, legs and body that enables them to glide from trees, sometimes as much as 100 metres. They are the last living examples of a complete order called Dermoptera (skin wings). There is only a single genus, Cynocephalus, containing two species which live in Southeast Asia.



The more familiar flying squirrels, which also glide on flaps of skin, are supposed to have evolved independently, and not quite as far. The colugos have extra webs between their neck and shoulders, as well as between their fingers and toes. The overall result is a much finer control over gliding, soaring, and landing. The flying fox is different again. It is a bat, and as such it can truly fly, flapping its bony wings.

Meanwhile, back at the fossils

Rather than isolated skulls, jaws and teeth, two skulls with partial skeletons were found. For the first time there was a clue to which heads went with which bodies. This led to the discovery that the fingers, wrists and ankles of two types of the earliest supposed primates, had features in common with the flying lemurs, related to their gliding skills. Along with a rare find that had details of the middle ear, and blood supply to the brain intact, this was more than enough to show that the Palaeocene remains were those of ancient dermopterans.

To quote Pat Shipman in New Scientist: "That a very small number of new specimens have so revised our views of what was thought to be a well understood time period is heartening. There are still surprises in store for us; there are still new worlds to be discovered in the past."

Comment.

A freelance journalist may find it heartening, but it actually shows that making up stories about which separately created kinds are supposed, in fact, to have evolved into others, is not the sort of science that can stand close scrutiny. Neither would any 'new world' receive any widespread acceptance if it seemed to have been created by a Holy God. Less likely still if it also contained initially perfect beings, who misused their free will, and in the resultant Fall blighted the whole of Creation. In today's climate (sic) of opinion, such ecological vandalism might call for a high price to be paid. The sins that people wink at are subject to fashion.

Rocks and Scripture: Investigating the Earth's History

Michael Garton

Creationists have recognised something of the desolations the Lord has made in the earth, and have used the order of these events to reconstruct the history of the Flood. Together with the Bible, this sequential order is the key to understanding the history of the earth since Creation. However, I would suggest many creationists have not fully grasped that there is a sequential order. Worse still, we have sometimes forgotten to take it into account, or even tried to deny this order in attempting to refute evolution.

Standing in Awe at Earth History

"Come, behold the works of the Lord, what desolations He has made in the earth." In Wales we see unthinkable vulcanism, the depositing of rock layers 10 miles thick. Almost certainly this occurred in just the early months of the Flood. Man is not the product of evolution supposedly recorded in these layers, but these very layers are a **consequence** of the rebellion of man against the Lord who created him, the heavens and the earth. It never ceases to fill me with awe and wonder to examine cliffs and quarries and consider the acts of the Lord.

The world over, rocks bear silent – but often stunning – testimony of the consequences of Adam's rebellion against God, and of our individual need for reconciliation. I therefore make no apology for my interest in rocks. Is it not remarkable that Peter, in his second letter, predicted the scientific climate of today, which chooses to be ignorant about the Flood? Man chooses to ignore past judgment because he does not want to face the future judgment.

Peeling back the Layers of an Onion

When investigating earth history, creationists are mindful of the need to check assumptions that cannot be proven against what the Bible has to say. In the first article in this series I suggested that some popular creationist ideas are untenable from Scripture. In their place I outlined some new ideas – especially that the Flood began very suddenly, and violently. In considering geology, again I suggest there is a popular creationist misconception, for which I offer a correction. It is that creationists have sometimes failed to appreciate (or even tried to deny) the sequential character of earth history.

The Bible states the Flood was awesome. For the sake of illustration, suppose the Flood laid down a layer of mud over the whole earth. This mud will be called 'Layer A'. Suppose that after this, two more events occur in earth history. Each event affects part of the earth, also covering it with a layer of sediment, so that Layer B is followed by Layer C.

The world would then show evidence for these three events. Drilling a hole in the earth, in some places the full succession would be seen:

Layer C
Layer B
Layer A (at the bottom)

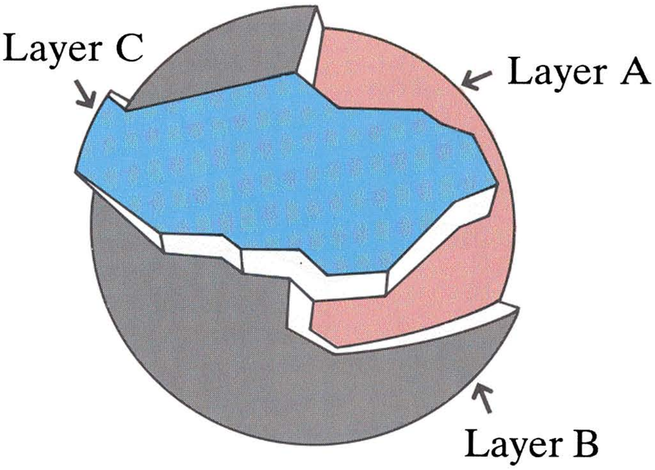


Figure 1 : Sequential global layers
The earth is rather like a giant onion: some rock layers form vast sheets like layers of an onion. Each great sheet records some 'event' which led to its deposition.

although in other places, as the diagram shows, Layers B and C may or may not be present.

Looking at actual rock layers all over the world, a certain order does emerge. Sometimes this order is mistakenly thought to depend upon the evolutionary assumptions that are made about the fossils within each layer. However, the sequence of layers consists not just of fossils, but often of distinctive rock types, forming vast sheets around the earth. Understanding earth history involves working out which sheet of rock is on top of which: it is rather like peeling off the layers of an onion. Each successive layer records, of course, a particular (and often peculiar) event in the history of the earth.

Geology, then, reflects the actions and consequences of the Lord's dealings with man. Let us beware, lest we look on too small a canvas. Creationists ought to be the first to fit the local quarry, sea cliffs etc., into a global and historical perspective. Let me illustrate this by considering just how vast the original extent of the chalk was, and hence how extensive (and unique) the event was that caused its formation.

Chalk - A Vast Sheet of Rock Recording a Peculiar Event

On the island of Arran, (just west of Glasgow) is an extinct volcano. Molten magma from deep within the earth once burst through the rock layers and spewed out. All this was removed by erosion long ago - both the lava flows and the rock layers close to the surface at that time. However, the centre of this volcano collapsed downwards (see Figure 2). Some of the rock layers subsided with it. One such layer was the chalk. Great blocks of this chalk can now be found on Arran, fortuitously preserved in this one place. Chalk is not found elsewhere in Scotland, but similar geological detective work allows us to conclude that it once covered most, if not all of Scotland.

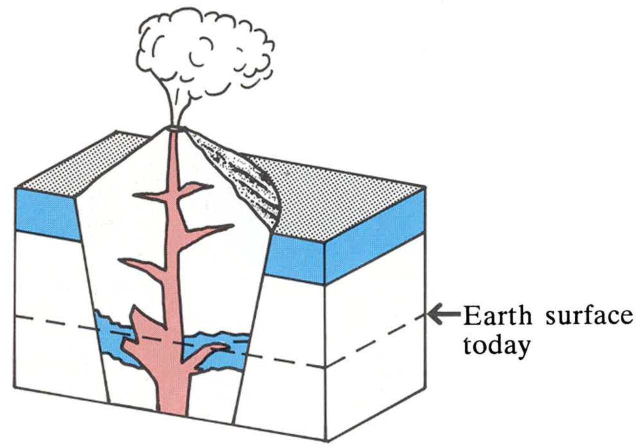


Figure 2: The Volcano on Arran
The layer of chalk on the island of Arran, through which a volcano burst through. The volcano, and surrounding chalk, have been removed by erosion. Today, the surface of the earth is at about the level of the dotted line.

Let us build up the picture a little more. Driving from London to Bristol along the M4, the motorway is built on (or above) the chalk, until the long descent at Junction 15. This hill is literally the edge of a vast and thick sheet of chalk which appears to have once extended north to Scotland (even if largely eroded away now). How far west did it originally extend? In Dorset we find low hills, only existing because their tops are capped with flint gravel - flint which originates in the chalk. Here is a hint that the chalk extended over Dorset. In the English Channel to the south, and on the sea bottom all around Ireland, we find these same layers of chalk, suggesting it was indeed once a continuous sheet in the west also. Going much, much farther west (leaving aside for the moment whether the Atlantic has always been there) we find the same chalk again in some of the southern states such as Alabama.

Let us now look in the other direction - eastward. Chalk underlies London and forms the white cliffs of Dover. The channel tunnel is excavated in chalk, and it covers all of northern France. Away to the north, this vast sheet of rock forms the cliffs of the Danish islands. If you refer to the map of Europe opposite, you will see this great sheet, coloured pale blue. It is the uppermost layer shown. It is now much dissected and removed by erosion, so it is no longer a continuous sheet. Its former continuity would be more evident if I had also shown that it floors most of the sea surrounding the British Isles.

Farther still to the east, the same layer is seen in Turkey, and it reaches into Afghanistan. Chalk does not continue all the way to Western Australia, but the same chalk is also found there. Chalk is a most peculiar rock. It must reflect peculiar conditions that lead to its formation. It is deposited upon an appreciable part of the earth. Hence, in considering earth history we must allow for an event which has caused all this chalk to form. Where does this chalk-forming event fit in ?

Sequential Events in Earth History

There are other 'events' to consider, and we must decide if they happened before or after the chalk-forming-event. Where evidence for the 'Ice Age' can be found today, it is always on top of the chalk. Remains of the 'Ice Age' are never found underneath the chalk, always on top of it: that is, the ice came later, after the chalk layer had formed. Remains of dinosaurs are found below the great chalk sheet, and the dinosaurs were dying out as the chalk was forming. (In accelerating conventional earth history in accordance with the Scriptures, a link between chalk and death of the dinosaurs is suggested). Below the chalk, and the rocks containing dinosaurs, coal is found. The rock layers containing this coal form a truly enormous sheet of rock. In the northern hemisphere, it stretches from Kentucky to China, very nearly half way round the world, and is almost indistinguishable from one end to the other. Where dinosaur remains are found, they are always above this coal, never under it. We have, then, successive rock layers corresponding to a sequence of events of global significance:-

Evidence for an 'Ice Age' (not shown on the map for the sake of clarity)

Chalk Forming Event, dinosaurs die out - most of the pale blue

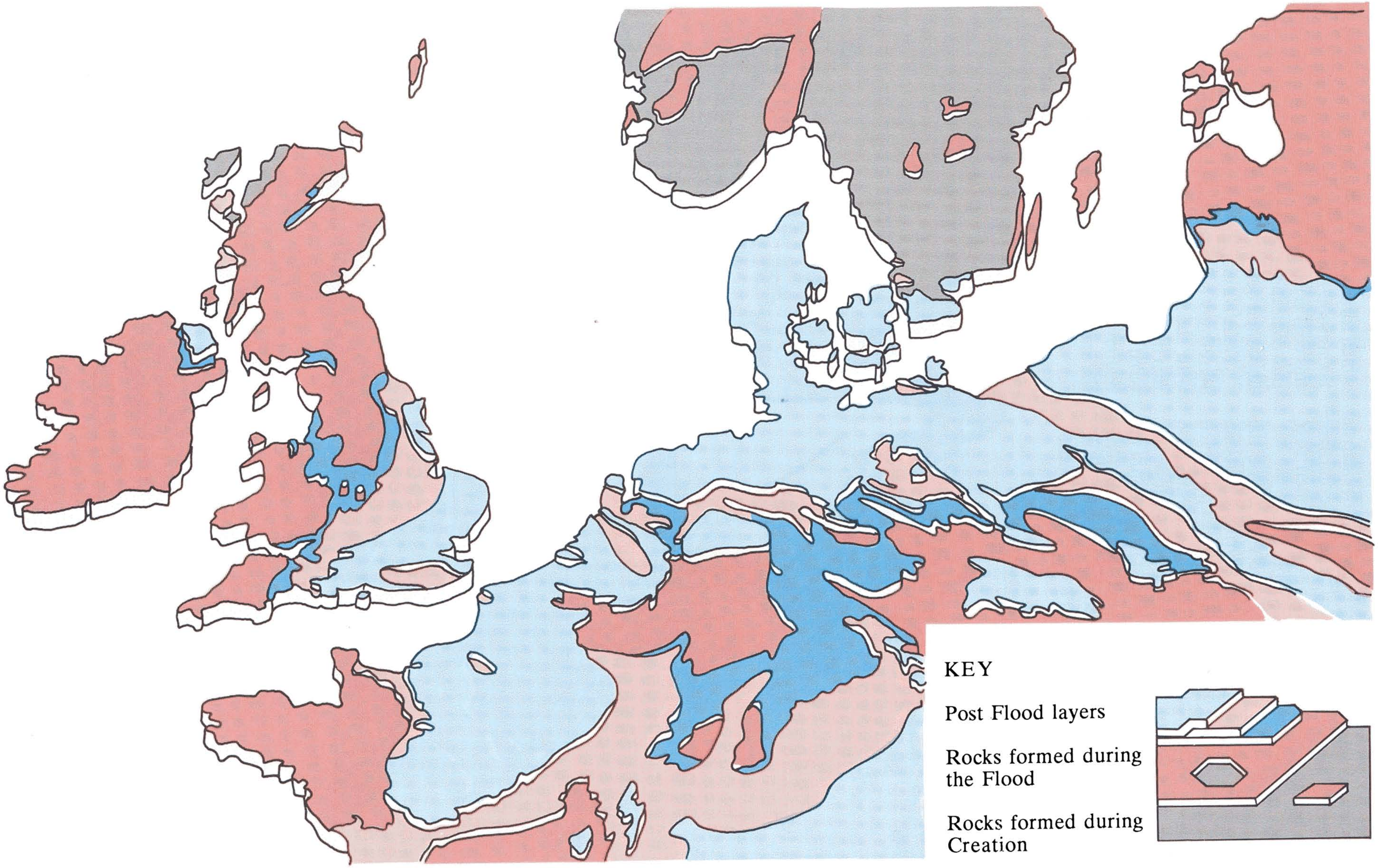
Rocks containing the acme of the Dinosaur - shown in light brown

'Age of Coal Formation' - partly corresponds to the dark brown

If we always take this sequential layering into account, it will save us making mistakes. For example, we can observe that coal is familiar in the west and north of England, and dinosaur remains have only been found in the east and south. It might then be (incorrectly) suggested that the vegetation which comprises the coal was being buried in the north west whilst dinosaurs were alive and well in the south east. What really happened was that the coal bearing rocks were deposited all over England, many years before the dinosaurs came to prominence. Dinosaurs may well have lived in the north west but this was some time after the coal had formed. Why are dinosaur remains no longer found there?

The east and south of England has been sinking since the Flood, burying and preserving the successive rock layers. In contrast, the west and north has been rising, so that the upper layers have been elevated and stripped away. Dinosaur remains have been removed, along with the chalk. Hence evidence for the dinosaurs has been preserved around London, but removed from the west and north. A more careful enquiry would have established that the succession **throughout** England was first coal, followed later by the dinosaur remains. For example, in

The Rock Layers Which Make up NW Europe



the south east, coal used to be mined in Kent. To reach the coal, the miners had first to excavate through the dinosaur bearing layers: that is, this coal always formed first, before the time of dinosaur fossilisation.

What I am suggesting here affects many of the interpretations popular in creationist writings. As an example, consider the millions of mammoths preserved in the Arctic. At first it may seem a reasonable assumption that they were swept there by the Flood. However, whatever explanation is offered, it must first account for the dinosaur bearing rocks, and the coal, which **underlie** the mammoth graveyard. It is extremely unlikely the mammoths were swept there by the Flood. The vegetation which formed the coal would first have to be deposited, taking some months. There are good reasons for suggesting this coal is from the waning stages of the Flood. Above this coal, there are still further layers which had to be deposited before the mammoths arrived.

There is a mammoth graveyard. Millions of mammoths were overwhelmed by a catastrophe, apparently associated with sudden freezing. The regional picture, however, is that this was a 'late' event. Realising that there are events (coal formation etc.) which must precede the death of the mammoths leads me to suggest that it is much more likely the mammoths died out in some post-Flood catastrophe.

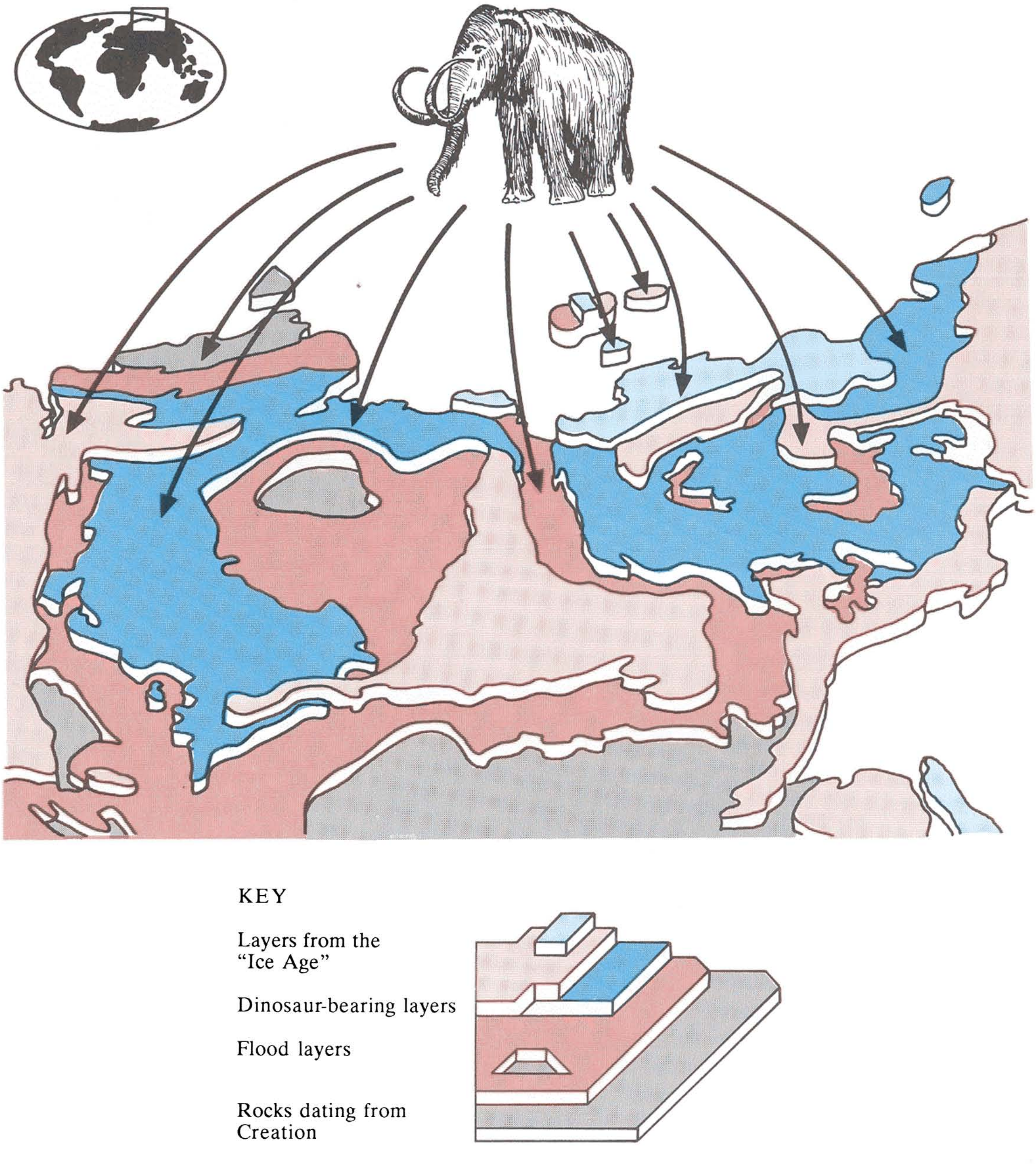


Figure 4
The Siberian mammoth remains are found on top of all earlier layers. Their destruction must have occurred late in the earth's history, and certainly not at the beginning of the Flood, as some have suggested.

Great Sheets of Rock Laying One on Top of Another

Remember that the tilting of Britain causes the youngest rock layers to be preserved in the London region, the oldest to be laid bare in the north west. On the map of Europe, the various events since Creation then become apparent, expressed in the various rock layers. In the far north west, rocks from what I would classify as Creation Week are brought to the surface (coloured grey on the map). Lying on top of these are the Flood layers, forming the landscape of most of Scotland, Wales and North West England. Above this come layers coloured blue, then light brown (containing the dinosaur fossils) and pale blue (the chalk). The same pattern is evident in Europe. In Scandinavia, the Flood layers are clearly seen, overlaying those from Creation. Further south, the same picture emerges of successive layers, although strong erosion has removed some layers prior to the deposition of the later ones.

The Sequence Contradicted? - Only in Mountain Belts

If you are familiar with creationist views, you may by now be a little puzzled. You will be aware that creationists recognise something of the order to the rock layers. (It is only because of this order that the story behind the layers can be unravelled.) But you may also be aware that some creationists have emphasised places where the layers are not in the usual order I have been describing. Examples are often cited from the Canadian Rocky Mountains. However, I know of no examples where such reversal of layering occurs outside of disturbed regions or mountain belts. Mountain belts are linear zones, usually on the margins of continents.

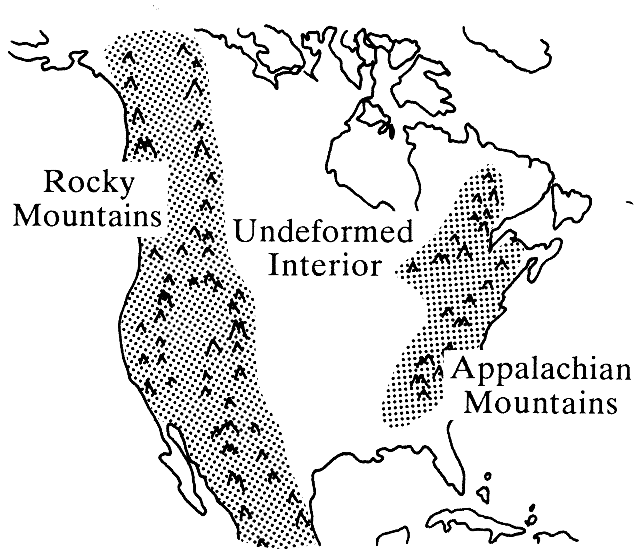
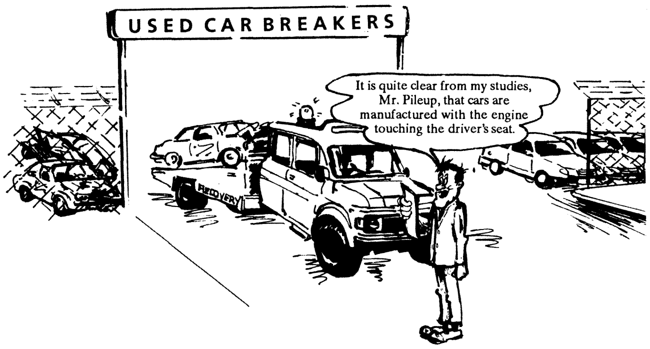


Figure 5
Out of order rock sequences are never found in the undeformed regions of continents, only in disturbed areas or mountain belts such as the Rockies or the Appalachians of N. America.

The distinguishing feature of mountain belts is that the rocks are deformed, folded and thrust one on top of another. It is hard to comprehend the enormous forces that have operated, and the scale of the deformation they have left behind. Yet on a smaller scale, it is possible to find many examples where the thrusting of an older layer over a younger one (reversing the usual succession) may have left very little evidence, even though such movement can be proved. This is confirmed in many cases where the same two layers can be traced across a continent (where there is no hint of disruption), and they are always in the familiar order. The interior of North America is such an example of an undisturbed region.


USED CAR BREAKERS
It is quite clear from my studies, Mr. Pileup, that cars are manufactured with the engine touching the driver's seat.
RECOVERY

Scrap-yards are not the place to study the manufacture of cars!

On the margins of the continent are the disturbed regions. It is from these zones that 'out of order' rock layers are cited by some creationists. But it is only when the layering is crossed by a mountain belt that the reversals occur. Without question, there is **always** evidence for folding and disruption in mountain belts. I suggest that creationists ought not to try to disprove evolution using such evidence from disturbed regions. Within them, the rocks may be thrust out of order, but this is a later event, quite immaterial to the sequences of earth history that lead to the formation of each great sheet of rock.

There are vast, undisturbed regions on all continents to demonstrate, if it were possible, that the rock layers are not in the usual order. Such reversal has never been found. Outside of mountain belts, what remains preserved of the sequence is always in the expected order, except for occasional anomalous (to the evolutionist!) fossils.

Accepting the Sequence, but Rejecting Millions of Years, and Evolution

The creationist position may seem threatened by having to accept that rock layers are in a definite succession, reflecting a sequence of events which formed them. It takes more time for events to happen in sequence, rather than all at once. Event A has to happen first, and is only then followed by B, and then C. Instead, if A, B and C all take place at the same time, it takes far less time (and throws evolutionary theory into disarray). However attractive this may be, I have tried to emphasise that rock layers actually record a sequence of events. Because of the scale of the Lord's dealings, each event may be reflected in continent-wide layering, building up the layers of the onion.

I suggest, then, that there is a definite order to the rock layers of the earth, and the fossils tend to be in a certain order also. In recognising this sequential order to the rock layers, I must emphasise that it is quite independent of evolution, or belief in a millions-of-years-old earth. The sequential order is a matter of geometry: which layers of the onion are on top of which. Geometry can be checked out and proven. Conversely, evolution has not been verified; it remains without proof. Also, I have said nothing about how long each rock layer takes to form. Creationists ought not to try and refute what I suggest is an actual sequence. Creationists ought rather to be seeking to understand how fast each layer must have been deposited.

In making generalisations about the earth's complex history, I could be accused of being too simplistic. Even when originally formed, the various rock layers were neither uniform nor continuous around the whole earth. Referring back to Figure 1, it is thus possible that the right hand part of Layer C (where Layer B is missing) started forming earlier, so that Layers B and C were in part forming at the same time. I would readily embrace such refinements. The most pressing need, however, is for creationists to first grasp the overall picture: the sequential nature of the rock layers – and events – of earth history.

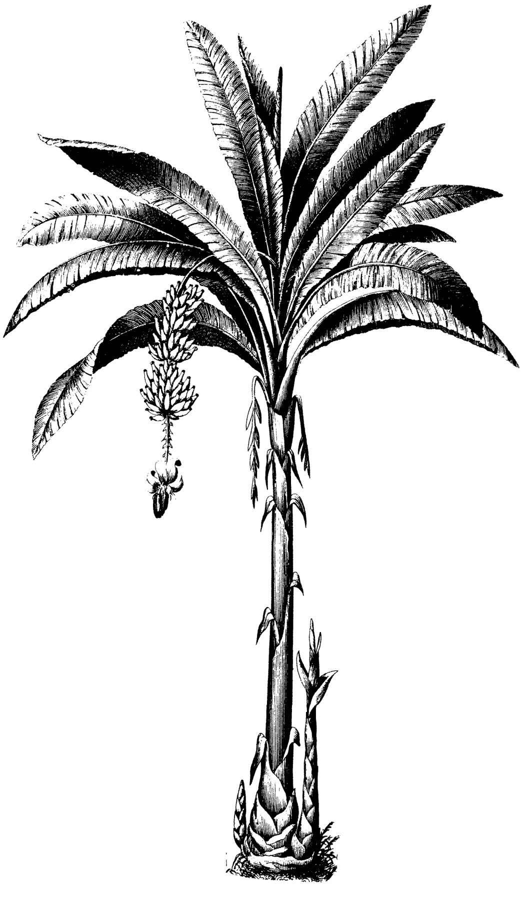
Know Your Onion

The various rock layers record events in the earth's history. Although in principle like the layers of a giant onion, each great sheet of rock was not deposited as a completely continuous layer. It will also have had to endure violent earthquakes and powerful erosive forces which removed vast amounts. This is illustrated by the once continuous sheet of chalk over Britain. But where each layer of the onion is found, it is in a definite order with respect to the layers above and below it. Creationists are not at liberty to interpret the local discovery without some regard to the regional or even global perspective.

In the last article I suggested that the Flood came suddenly, and life was quickly blotted out: hence rocks from the Flood should contain little evidence that air breathing creatures were alive, and largely record evidence of death and dead creatures. Rocks from before the Flood will probably be free of fossils. Rocks from after the Flood may show evidence of death, but they may also show abundant evidence of creatures going about their daily lives, 'enjoying' life: evidence of things alive. This is one criteria for distinguishing between rock layers formed during the Flood from those formed afterwards, or during Creation Week. Creationists must recognise the vast extent of some rock layers (the coal I have referred to here is one example), and decide whether they may be from the Flood or not. These layers of the onion then become marker layers recording successive events in earth history.

Many of the events recorded by such sheets of rock were unique. The earth has passed through various stages, each never to be repeated again. Never before or since have so many billions of tonnes of vegetation been buried as in the global coal layers referred to here. Again, the chalk - formed of algae skeletons - records an extraordinary growth of trillions of algae. Their explosive growth, to dominate the seas for a short season, must have altered the atmosphere in such as way as to render the present concern over the greenhouse effect laughable in comparison. The evolutionist has no real answer to these global disasters. My understanding of rocks and Scripture leads me to declare them as the record of the Flood, and the ecological climaxes and disasters which followed.

Even the earth has staggered at the weight of man's rebellion against God. I give my conclusions regarding the layers we have been considering. The trees and plants of the coal give a hint of the prolific and luxurious vegetation which existed before The Flood, and which were buried at the end of it. The mighty dinosaurs and the microscopic algae of the chalk each, for a season, found niches in which to breed prolifically, as the earth staggered, reeled and stabilised in its recovery from The Flood. The 'Ice Age' was but the final hiccup.



Pre-Flood Limestone Deposition

Daniel Wonderly

Some Parts of the Sedimentary Cover which Evidently were Formed Prior to the Biblical Flood

In accepting the true historicity of the Book of Genesis, we necessarily assume that the Biblical Flood occurred less than 100,000 years ago. Because a high percentage of the earth's sedimentary strata are of types which apparently could have not been laid down rapidly by flood waters and could not have acquired a significant degree of lithification without long periods of time, it seems necessary to accept the geologic evidence which indicates that most of the sedimentary cover of the earth was laid down before the flood.

Limestone Strata Underlying Broad Areas on the Continents

Deep drillings in search of petroleum on the continents have provided us with a knowledge of many thick limestone formations extending over an immense area of the earth's crust. (This use of the word "formation" refers to a set of related strata lying one upon another in vertical sequence.) Many of the limestone formations are hundreds of feet thick and it is not uncommon for such a formation to be a few thousand feet in thickness (Chen, 1977). Often the lower ones are a few miles below the surface and usually there are some thick, non-carbonate formations (shale, siltstones etc.) lying between the limestone formations.[1] [*See end notes*]

In order to think accurately about the origin of the limestone strata of the earth, we need to reckon with the immense amounts of this rock which exist and also with the precise makeup of the rock material in the strata. Creationists who have proposed that most of the limestone on the earth was deposited during the Biblical Flood, have hypothesised that it was derived either from inorganic precipitation out of sea water, or from large amounts of carbonate skeletal material (sea shells, algal plates etc.) which might have been swept in from the oceans. A further suggestion is that it was derived from a combination of these two processes. A study of the low amounts of calcium and magnesium carbonates contained in even super-saturated sea water makes the hypothesis involving inorganic precipitation of limestones untenable. This is even more so when we consider the fact that precipitated calcium and magnesium carbonates are formed as very small particles which require long periods of **tranquil** water for settling out.

As for the carbonate skeletal-material hypothesis, mentioned above, we must consider the following problems:

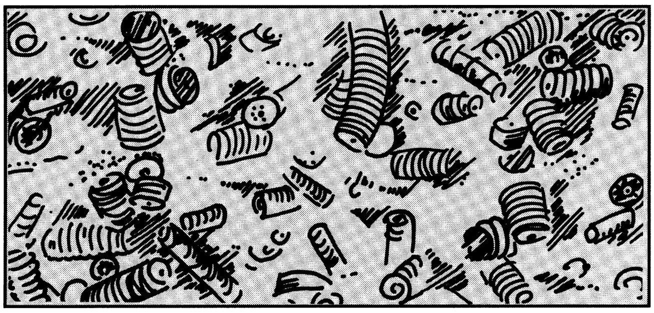
1. To suppose that enough seashell materials were stored in readiness around the North American continent, available to be swept in by the Flood and deposited in neat layers to the thickness cited above and over such broad areas, is completely out of harmony with the physical laws which control organic growth.
2. Science knows no way by which the flood waters could transport all the shell material inland, even if it had been stored in readiness and distributed evenly over such broad areas of the continent from 640 km to 1120 km from the "storage depot".
3. There is no conceivable way that the surging flood waters could transport the shell material inland **without mixing it with** terrigenous materials on the way. Also, how would the flood waters bring in layers of pure clay and silt or sand a few minutes later, to deposit the shale and siltstone or sandstone layers over great areas of shell material?
4. We must face the facts of physical laws which control sediment suspension and transport and realise that fine sediments cannot settle out of surging flood waters to form neat, smooth and uniform layers [*Please see Editorial Note* (a) *at end*]. Similarly, seashells of all sizes do not float like masses of seaweed and then suddenly sink down in a uniform layer. (To suppose that deposition of sediments occurred in such a manner violates the physical laws which God created.)

Thus, no method is known to mankind by which even a small fraction of the existing limestone strata could have been deposited by either precipitation or following rapid transport of shell materials. During the last three decades, the worldwide, extensive research on carbonate sedimentology has provided us with abundant evidence that most of the limestone strata of the earth are of biogenic origin and were formed by natural processes in the environments where the lime-secreting organisms were growing. The presence of large quantities of both calcareous and siliceous microfossils in limestone strata has contributed to our understanding of the biogenic origin of limestones.[2] Tucker (1981) summarizes an immense amount of carbonate research when he says "Biological and biochemical processes are dominant in the formation of carbonate sediments; with few notable exceptions, inorganic precipitation of $CaCO_3$ from seawater can rarely be demonstrated." (see also Wilson, 1975a).

In recognising these discoveries, we need to realise that the great development and expansion of research in the field of carbonate sedimentology during the past three decades has been almost entirely a project of petroleum research and not at all an effort to confirm or demonstrate evolutionary theory. The realisation of petroleum geologists that a large proportion of the oil reserves of the world is held on porous limestone formations caused them to concentrate on understanding how and where the various kinds of limestone were formed so that they could better predict the amounts and locations of petroleum occurrence.

Some Special Characteristics of the Limestones of the World

As research on carbonate sedimentology has continued, an immense amount of data regarding *in situ* biological growth structures in limestone formations has been published. These growth structures include stromatolites and algal mats (both formed by marine algae which either collect or secrete calcium carbonate), small bioherms, large organic banks and coral-algal reefs. Obviously, any limestone formation which contains such structures could not have been formed by rapid precipitation or by transport of calcareous shell material from elsewhere during the flood. All of these kinds of growth structures are found in Europe as well as in North America and the technical literature in this field is truly abundant. (see Walter, 1976 on stromatolites and carbonate algal mats, this includes a bibliography of 2,034 entries; also Wilson, 1975b on ancient reefs and bioherms).



Crinoidal Limestone: largely made up of the remains of 'sea -lilies', whose skeletons consist of calcite plates.

It is true that the identification of the algae which produce ancient stromatolites and fossilised algal mats was difficult at first, but with the advent of the scanning electron microscope and the improved usage of standard electron microscopes, it became possible to see and identify the cells and filaments of the fossilised algae in the stromatoids (Walter, 1976b and Flugel, 1977). Further to this, the present day formation of calcareous algal structures of types very similar to these fossilised structures has been observed in many places such as the Bahamas, Bermuda, the Persian Gulf, the Red Sea and the western coast of Australia (Friedman *et al*, 1973; Ginsburg, 1975 and Walter, 1976). In comparing these and other features with ancient limestones we find abundant evidence that a large proportion of the limestones of the earth were formed in warm, shallow seas, with the cementing together of the skeletal particles beginning after they had been slightly buried by bottom currents (Reading *et al*, 1986a).

With the great amount of data such as we have been citing, which indicate that at least practically all limestone strata were produced slowly, we have every reason to believe that these carbonate strata were formed long before the Biblical Flood and also long before the creation of Adam and Eve. (The author does not accept an evolutionary view of either the human race or of the organisms which produced the limestones and fossils of the earth). Evidently, the early strata discussed here were formed as a result of the growth of lime-secreting algae (not listed in the Genesis account) and by the many kinds of shell-producing marine organisms which God created. Genesis 1: 20-22 refers to some of the latter which were created on the fifth day of creation.

Attempts to postulate that a super-rapid growth of lime-secreting organisms between the time of Adam and Noah produced most of the limestones of the world are unsatisfactory, because they fail to reckon with the actual amounts of biogenic limestone to which we have referred. They also fail to recognise that the chemical and physical laws, by which biological growth is made possible, are stable and not erratic [*Please see Editorial Note* (b)]. The Book of Genesis leads us to believe that biological growth processes during Adam's life were necessarily similar to what they are at the present time. Even today, when a group of aquatic organisms begins to reproduce too rapidly, they soon choke themselves with their own waste products and their dead bodies then pollute the entire area. A further problem for rapid growth hypotheses is that, if we postulate that the great thicknesses of limestone were produced during the short time between the creation of Adam and the Flood, there would be no way to account for the thick formation of terrigenous sandstones, siltstones and shales which are intercalated in the limestone formations.

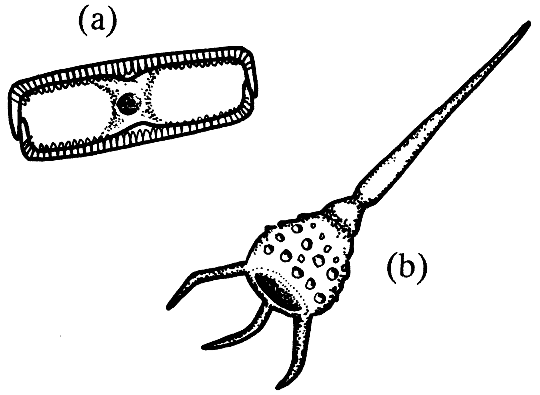
The Selective Distribution of Fossil Types in the Sedimentary Strata of the Earth

A very significant characteristic of the earth's sedimentary cover is that many kinds of fossils appear only in the lower rock systems (eg. Cambrian and Ordovician strata but not in the Triassic or Jurassic), whereas other distinct kinds of fossils are found only in the upper rock systems. It has sometimes been assumed by creationists that there is no particular order of fossil distribution such as this. However, every petroleum geologist is well aware of the distinction between fossil types in the local geological columns of the oil fields. In fact, the lower rock systems, often very deep in the oil fields, contain many species and sometimes whole families of fossils which are not present in the upper rock systems, apparently having become extinct. If all the strata had been laid down during the Flood, this isolation of fossil types from each other would not have been achieved, unless some suitable sorting mechanism was in operation. However, no possible sorting mechanism is known, since the isolation of types is found almost everywhere, without any evidence of a difference in density, size, or shape of the groups of fossils involved.

We will here cite and briefly explain two examples of this distinctive distribution, namely, microfossils and corals types.

1. Microfossil types

It is well known that the world's oceans are teeming with floating micro-organisms of many kinds, some of which produce shells (skeletons) for themselves. Two of the most abundant of these are diatoms and radiolarians. Both have shells composed of almost pure silicon dioxide, which makes them very resistant to dissolution in most natural waters. Because of this feature they have been preserved as fossils in a large proportion of the sedimentary strata of all the continents.



Silicate skeletons: (a) Diatom (b) Radiolarian

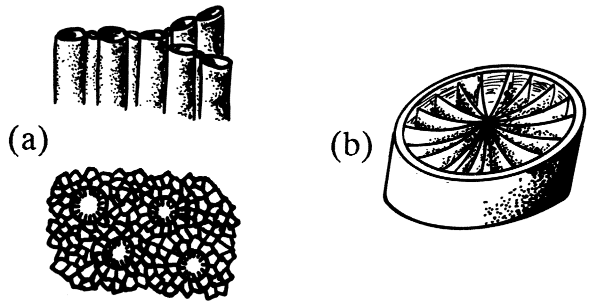
Radiolarians and diatoms both live floating in the same ecological zone of the ocean, the upper waters of the open sea (pelagic zone). (A few species of diatoms live on the sea floor if the water is not too deep as to exclude the light.) Both of these organisms are so widely distributed that they are abundant in the ocean-floor sediments in practically all parts of the world. They are frequently found in highly concentrated accumulations of from 100-600 metres in thickness, covering very broad areas (U.S. Government, 1969-1976). The sizes of radiolarians and diatoms are not radically different from each other and they are transported equally well by water. Yet worldwide, the diatoms are found **only** in the Upper Mesozoic and younger rock systems of the earth, whereas the radiolarians are found in all systems from the Ordovician to recent strata (Haq, 1978). This distinctive difference has been universally recognised for many decades as ubiquitous throughout the world, being demonstrated in hundreds of new oil wells each year, as well as in exposed rock formations in most parts of the world. It has therefore been universally recognised as a demonstrated fact for many decades. Since there is no known way by which flood waters could sort or deposit these fossils selectively, it is evident that **at least** the rock systems from Palaeozoic to the Middle Mesozoic (Jurassic) were already securely in place at the beginning of the Flood. Otherwise, an abundance of diatom shells would have been mixed into the Palaeozoic strata of the continents, if the strata were being formed or disturbed by the Flood.[3]

2. Coral types

We are referring to some of the types of "stony corals" which grow in large colonies in the oceans, form reefs. The coral animals (polyps) are small, soft-bodied cnidarians (coelenterates) which have the ability to secrete protective cups or tubes (skeletons) of calcium carbonate. After the animals die, the cups and tubes usually become permanently cemented together by the gradual building in of calcium carbonate crystals (cement crystals), which are precipitated from the seawater. In this way the limestone reefs are formed. If parts of the reef are exposed to fresh water from rain, by a lowering of the sea level, this lithification process is enhanced, forming more durable limestones. Many ancient, buried reefs found on the continents show freshwater cement crystals of these types.

In the fossil record, we find definite contrasts in the types of corals found in the lower rock systems compared with those in the upper systems. Within the phylum to which corals belong (Cnidaria or Coelenterata), there are three orders of corals which have been major producers of limestone formations.

Two of the most common and productive of these orders, Rugosa (tetracorals) and Tabulata (tabulate corals), are extinct and are found only in the Palaeozoic rock system (except for a few species in the Lower Triassic). No specimens of the third of the three major orders of coral, the Scleractinia, are found in any of the vast areas and thickness of the Palaeozoic rock systems of the earth (see Lehmann, 1983, Murray, 1985 and other textbooks of Invertebrate Paleontology for the stratigraphic ranges). These corals, often called scleractinians or hexacorals, have, together with algae, built all of the many great reefs which are found in the oceans today and also many that are found in the limestone deposits from the Triassic system to the more recent Quaternary. This order of corals includes many solitary, as well as colonial species. Of great significance for our consideration of fossil distribution, is the fact that the scleractinian corals all have very fundamental and obvious morphological differences which distinguish them from both of the great extinct orders that we have just discussed. This means that there is no possibility of confusing them with the orders Rugosa or Tabulata when they are found in the field, or as one examines museum specimens.



(a) Tabulate Corals (b) Rugose coral

If the Flood was accomplishing the laying down of the sedimentary strata of the continents, as many young-earth creationist authors visualise, there is no logical way even to imagine how the enormous quantity of scleractinian corals on the earth could have escaped being mixed into the deeper (Palaeozoic) rock systems of the continents, since the skeletal masses and fragments of these corals are all **at least as** dense as those of the other corals of the earth.

Some young-earth creationists have assumed that the isolation of contrasting fossil types in the geological formations and systems could have been accomplished during the flood by some kind of "ecological zoning" process. Obviously, ecological zoning could not have produced the distributions of any of the fossils we have described above, because both the diatoms and radiolarians lived in the same ecological zone and all three of the orders of corals we have described grew in the same zone (see Wonderly, 1987 for a more detailed explanation).

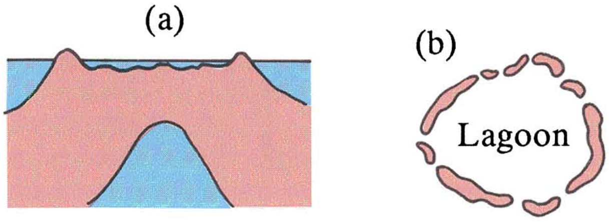
Thick, Localised Build-up of Limestones

There are a great number of *in situ*, organic banks of limestone buried in the rock systems of the earth (Reading *et al*, 1986). Some of these are true coral reefs containing many well-preserved fossil corals. Lack of space will prevent the giving of any detailed description of these reefs and other organic banks in this article, but details can be found in the research reports from Canada cited below.

The average and maximum growth rates of modern coral reefs and related organic banks are fairly well known and it seems to be necessary to assume that the ancient reefs grew at similar rates. The growth rate principles given above should prevent our postulating enormously faster rates. One of the most thorough investigations of the growth rates of coral reefs was made by Mayor and his associates during the years 1917 to 1929 (Mayor, 1924). They found that the fastest upward growth rate of reefs in the tropical Pacific was approximately 8 mm per year (8 m per 1,000 years).[4] This accumulation rate is several times faster than that of any known accumulation by non-coral, lime-secreting organisms. For example, in the shallow water of the Great Bahama Bank, off the south east coast of the USA, an area of normal semitropical growth, the rate is only approximately 30 cm per 1,000 years (Goodell and Garman, 1969).

In the northwest part of Alberta, Canada, there are several oil fields where major oil production is from ancient, Devonian coral reefs (Keg river formation). These buried reefs have been studied in great detail by petroleum geologists. Research teams used large numbers of high quality drilling cores taken from each of several of the atoll-type reefs and seismic surveys, which accurately determine the size and shape of each atoll. Many species of reef-building corals have been classified from these cores and significant numbers of the specimens were found in a growth position. The thickness (height above base) of some of the atolls and other reefs is as much as 240 m (800 feet) and the shapes of some of them are strikingly similar to living atolls now found in the Pacific Ocean (Langton and Chin, 1968; Hriskevich, 1970 and Barss, 1970).

These reefs in Alberta are far inland on the continent and are covered by a layer of sedimentary rock approximately one mile thick showing distinct features of slow deposition at many levels. It seems necessary, therefore, to accept the evidence that both reefs and at least most of the rock formations above them were produced before the Flood. For example, the drilling cores taken from many of the reefs in northwest Alberta, show that reef growth was similar to that observed in modern reefs, but that the growth was often intermittent.



An atoll: a coral reef of elliptical or horse-shoe shape enclosing a lagoon. (a) Section (b) Plan

The apparent reason for the interruptions in growth was that the water level often became too low and the evaporating water in the inland sea which then covered that area became too salty for coral growth. At such times, the concentrated brine began to produce thin layers of precipitated minerals (evaporites) on the shallow sea floor. These lapped up onto the sides of the reefs where the corals, lime-secreting algae and other reef-forming organisms were still trying to grow. In fact, the stages of evaporitic sediments which were laid down in the basin around the reefs and at several levels up along their sides, give clear testimony to the extended struggle of these organisms to keep growing, but reveal that they finally succumbed and were completely buried in evaporite sediments (Langton and Chin, 1968; Machielse, 1972 and Bebout and Maiklem, 1973).

These cyclic, bedded, evaporite sediment layers which buried the reefs are the main component of the well-known Muskeg formation which extends across most of Northern Alberta, lying at an average depth of approximately 1,300 m and having an average thickness of about 180 m. Approximately 20 m of this thickness consists mainly of thin microlayers of anhydrite, frequently alternating with even thinner layers of pure calcium carbonate and of organic microlayers. Some of these suites of microlayers are precisely correlatable in cores from wells separated by a distance of at least 25 km, showing that they were laid down in very tranquil, stagnant seas (Davies and Ludlam, 1973).

Judging from rates of evaporation and precipitation in the most arid seacoasts of today, the Muskeg evaporites, which total 180 m, must have required at least several hundred thousand years for their formation. The suggestions which have been made by some creationists, that similar mineral layers are the result of catastrophic processes, such as hydrothermal springs or volcanic action, cannot possibly refer to the Alberta oil field; the data contradict such an idea at every point. (Evaporites are extensively studied by petroleum geologists because they form an almost perfect seal that prevents the escape of petroleum from underlying porous limestone formation in many oil fields of the world.)[5]

The reality of the growth periods for reefs in the ancient seas of northern Alberta and their subsequent gradual burial by layers of minerals deposited from the evaporating seawater, is so well documented and understood from the research of the past 30 years that no one who studies the research reports can deny the evidences (see Wonderly, 1987b for a fully documented summary).

The estimation of the length of time required for the burial of the Alberta reefs is further affected by more than 1,200 m of additional strata overlying them. These layers consist of multilayered formations of quartz sandstone, shale, siltstone, chert, limestone and dolostone[6], most of which are of types which cannot be laid down by rapidly moving water. Practically all of the layers of limestone and dolostone (from 300 – 600 m) are of types which show that they were formed by the usual, slow processes of limestone production in warm, relatively shallow seas.

In concluding, I wish to say that even though it is very evident that the great majority of the sedimentary strata of the earth were formed long before the creation of man, I do believe that the Biblical Flood was a major catastrophic event which destroyed all the human population except Noah and his family and geologically affected at least the shores of all the continents. For example, at various places along the coast of North America, there are sedimentary strata which are poorly consolidated, not having had time or opportunity for extensive lithification.[7] These probably could have been deposited by the waters of the Flood.

Endnotes

1. Diagrams showing the vertical order and thicknesses of limestone and other rock types and isopach (thickness) maps for many parts of the world, can be found in petroleum research publications such as the following Halbouty, 1980 (this book is worldwide in scope) and Cook *et al*, 1975 (an amazingly helpful and comprehensive work).

2. There are now a great number of publications which show and explain photomicrographs and electron micrographs of many kinds of microfossils embedded in ancient limestones. Two examples which are very usable for the undergraduate students are the following Adams *et al*, 1984 and Fischer, 1967.

3. For methods by which larger marine animals were apparently buried rapidly in sediment gravity flows of diatomaceous sediments see Wonderly (1987c).

4. The well-known Eniwetok (Einwetak) atoll reef in the Pacific has a thickness of 1,380 m (4,610 feet), resting on an extinct volcanic cone.

5. It would also be helpful to read the chapters on evaporites in 'Origin of Sedimentary Rocks' by Blatt, Middleton and Murray (1980), for gaining an understanding of the general principles and geochemistry of evaporite deposition.

6. Dolostone is carbonate rock, the main component of which is calcium magnesium carbonate (dolomite, $CaMg(CO_3)_2$). Most ancient limestones have had at least a small percentage of the calcium carbonate converted to dolomite during the long-term percolation of magnesium-bearing water through the pores of the rock layers.

7. A treatment of some of the main processes of lithification in relation to the age of the strata of the earth is given in Wonderly (1987d).

Editorial Notes

It must be clearly stated that the editorial team do not regard these points as undermining the important questions raised by the paper. If this were so, the paper would have been sent back for revision.

(a) It is unfortunate due to production deadlines the editorial team has not had the opportunity to ask the author if he has modified his opinion, in the light of evidences such as that from the Mount St. Helens eruption reported in the last issue of this journal ('Lessons from Mount St. Helens', Origins 3: 8, p.14). The finely layered bedding produced by airborne pumice, dust, and debris has also been independently modelled in the laboratory, for aqueous sediments. This was published, having been presented to the French Academy of Science in 1986:
BERTHAULT G., C.R. Acad. Sc. Paris, t303, Serie II, no. 17, 1986, p.1569-1574. (In French).
An English translation appeared as:
BERTHAULT G., Experiments on Lamination of Sediments, Ex Nihilo Technical Journal, Vol. 3, 1988, p.25-29.

(b) Population growth of organisms from small to large, is modelled by what is known as the 'Logistic Equation'. Factors leading to population growth are balanced by the feedback from negative influences such as overcrowding, disease and predators. Stable, oscillatory, and chaotic population variations have now been demonstrated for different adjustments of these factors. The theoretical predictions have also been observed in real ecological case studies. Knowledge of this work is only now becoming widely available with the growth in academic popularity of 'Nonlinear Dynamics' and 'Chaos Theory'.

References

ADAMS, A.E. (1984) 'Atlas of Sedimentary Rocks under the Microscope.' Longman, New York, USA, 104pp.

BARSS, D.L. (1970) Geology of Middle Devonian Reefs, Rainbow Area, Alberta, Canada. in 'Geology of Giant Petroleum Fields.' Ed. M.T. Halbouty, American Association of Petroleum Geologists, Memoir no 14, 19-49.

BEBOUT, D.G. and MAIKLEM, W.R. (1973) Ancient Anhydrite Facies and Environments, Middle Devonian Elk Point Basin, Alberta. Bulletin of Canadian Petroleum Geology, *21*, (3), 287-343.

BLATT, H., MIDDLETON, G.V. and MURRAY, R.C. (1980) 'Origin of Sedimentary Rocks.' Prentice-Hall, Englewood Cliffs, NJ, USA, 782pp

CHEN, Ping-fan (1977) Lower Palaeozoic Stratigraphy, Tectonics, Paleogeography and Oil/Gas Possibilities in the Central Appalachians. West Virginia Geological and Economic Survey, Reports of Investigations, *26*, Part 1, 26-67.

COOK, T.D. *et al.* (1975) 'Stratigraphic Atlas of North and Central America.' Princeton University Press, Princeton, USA, 272pp.

DAVIES, G.R. and LUDLAM, S.D. (1973) Origin of Laminated and Graded Sediments, Middle Devonian of Western Canada. Geological Society of America Bulletin, *84*, 3527-3546.

FISCHER, A.G. ed. (1967) 'Electron Micrographs of Limestones and their Nannofossils.' Princeton University Press, Princeton, USA, 141pp.

FLUGEL, E. ed. (1977) 'Fossil Algae : Recent Results and Developments.' Springer-Verlag Inc., New York, p57-60.

FRIEDMAN, G.M., AMIEL, A.J. *et al.* (1973) Generation of Carbonate Particles and Laminates in Algal Mats, Examples from Sea-marginal Hypersaline Pool, Gulf of Aqaba, Red Sea. American Association of Petroleum Geologists Bulletin, 57, (3) 541-557.

GINSBURG, R.N. ed. (1975) 'Tidal Deposits : A Casebook of Recent Examples and Fossil Counterparts.' Springer-Verlag Inc., New York, 198-232.

GOODELL, H.G. and GARMAN, R.K. (1969) Carbonate Geochemistry of Superior Deep Test Well, Andros Island, Bahamas. American Association of Petroleum Geologists Bulletin, *53*, (3) 513-536.

HALBOUTY, M.T. ed. (1980) 'Giant Oil and Gas Fields of the Decade 1968-1978.' American Association of Petroleum Geologists, Tulsa, OK 74101, USA, 596pp.

HAQ, B.U. and BOERSMA, A. eds. (1978) 'Introduction to Marine Micropaleontology.' Elsevier, North Holland, Inc., New York, USA, pp2, 203, 212-214, 224-230 and 245-256.

HRISKEVICH, M.E. (1970) Middle Devonian Reef Production, Rainbow Area, Alberta, Canada. American Association of Petroleum Geologists Bulletin, *54*, (12) 2260-2281.

LANGTON, J.R. and CHIN, G.E. (1968) Rainbow Member Facies and Related Reservoir Properties, Rainbow Lake, Alberta. American Association of Petroleum Geologists Bulletin, *52*, (10) 1925-1955.

LEHMANN, U. and HILLMER, G. (1983) 'Fossil Invertebrates.' Cambridge University Press, Cambridge, UK, 16-17, 32-33 and 35.

LEHMANN, U. and HILLMER, G. *Ibid*, 69

MACHIELSE, S. (1972) Devonian Algae and their Contribution to the Western Canadian Sedimentary Basin. Bulletin of Canadian Petroleum Geology, *20*, 187-237.

MAYOR, A.G. (1924) Growth Rate of Samoan Corals. in 'Papers from the Department of Marine Biology of the Carnegie Institute of Washington, Publication 340, *19*, 51-72.

MURRAY, J.W. ed. (1985) 'Atlas of Invertebrate Macrofossils.' Longman, New York, USA, 241pp.

READING, H.G., *et al.* (1986b) 'Sedimentary Environments and Facies.' Blackwell Scientific Publication, Cambridge, UK, 283-342.

READING, H.G., *et al.* (1986b) *Ibid* 327-338.

SANDERS, J.E. and FRIEDMAN, G.M. (1967) Origin and Occurrence of Limestones. in 'Developments in Sedimentology No 9A, Carbonate Rocks', Elsevier, New York, 193.

TUCKER, M.E. (1981) 'Sedimentary Petrology, an Introduction.' Blackwell Scientific Publication, Cambridge, UK, 96.

US Government (1969-1976) Initial reports of the deep sea drilling project, 1-36, US Government Printing Office.

WALTER, M.R. ed. (1976) 'Stromalites, Developments in Sedimentology No 20.' Elsevier, New York, USA, 790pp.

WILSON, J.L. (1975a) 'Carbonate Facies in Geologic History.' Springer- Verlag, New York, USA, 4-12.

WILSON, J.L. (1975b) *Ibid* 96-280.

WONDERLY, D.E. (1987a) Neglect of Geologic Data: Sedimentary Strata Compared with Young-Earth Creationist Writings. Interdisciplinary Biblical Research Institute, PO Box 423, Hatfield, PA 19440, USA, p60-70.

WONDERLY, D.E. (1987b) *Ibid* 78-96.

WONDERLY, D.E. (1987c) *Ibid* 55-58.

WONDERLY, D.E. (1987d) *Ibid* 33-38.

The Decay in the Velocity of Light : Real or Imaginary?

John Peet

[This paper reviews the ideas of Barry Setterfield on the decay of the velocity of light and some of the papers published on the same issue. Another member has been invited to submit a paper giving an independent analysis of the data and this will be included in a later issue.]

While a belief in a young earth (6000+ years old) is not necessary for a belief in "Special Creation," many creationists feel that the only acceptable interpretation of Genesis 1-5 requires such a belief. To them, the ages demanded by such techniques as radiometric dating, the time light takes to travel from distant stars, etc. are a problem. The work of Barry Setterfield is, therefore, attractive.

Setterfield did some very thorough literature research to find 163 values that have been determined for *c*, the velocity of light, by sixteen methods. He then analysed them statistically and proposed that c has been decaying over the last 300 years in accordance with the equation

$$c = 299792 + 0.01866.T^{2} + 3.8 \times 10^{-14}.T^{8}.$$

This is an exciting piece of work if it is valid. Exciting, not only because it is unexpected, but because of its implications in many fields since a number of factors are dependent on *c*. As a work by a creationist suggesting evidence for a young earth, one is naturally attracted to it. But, it must be subjected to the same rigorous scientific and scriptural analysis as we would seek to apply to evolutionary claims.

Unfortunately, a scientist is not impressed when the second sentence of the introduction involves an obsolete model of the electronic motion in an atom. This is not a helpful start to the paper.

Extrapolation

My first concern is the extrapolation that Setterfield has used and others would be tempted to apply. This is an extension of the principle of uniformitarianism. That is, a belief that the processes we detect in the present or immediate past have always applied. In this case, a mathematical relationship which may hold now has always applied. Extrapolation is bad science. We know that, even in basic science, extrapolation does not apply. If we allow that Setterfield's analysis is right, we do not know that the decay continued before 1650. It is also bad in terms of Scriptural exegesis. Any catastrophic event might render extrapolation invalid. The Great Flood is an example. Although the precise equation is not critical to Setterfield's thesis, it is very difficult to interpret experimental data statistically in order to distinguish between a straight line and a curve - a glance at most laboratory notebooks will demonstrate that!

Statistics

But then, we ask, is his analysis statistically valid? Several analyses have been done (see my bibliography) and the interested reader is referred to these for a thorough investigation. My immediate reaction to Setterfield's report was that, if it had been submitted to me by one of my students, I would have returned it as of doubtful validity. Interestingly, Setterfield refers to a more recent increase on even more slender evidence! ("If this trend is sustained, it would appear that CDK reached a minimum around 1975-1980 and is slowly increasing again." Setterfield, March 1989).

Statistics are often quoted with great confidence and eloquence in support of an argument, but they consist of data which must be interpreted. That interpretation has to involve a degree of common sense. The data have to be discussed in terms of the limitations on the original and derived values. In the case of data obtained in the past, there must be uncertainty arising from our analyses and postulates. When faced with analysing unrepeatable historical data, our approach has to be meticulous. It is, to a degree, a subjective branch of mathematics. Setterfield shows this in his selective use of the data.

Setterfield quotes correlation coefficients for his best line fits. In fact, correlation coefficients alone do not confirm that the fit is correct (see Tilley). Studying the experimental data, I find it difficult to substantiate any hypothesis about the value of *c* over time and I am certainly skeptical that a decay has occurred. (This is not to say that it has not decayed, but that statistically I do not think the case can be made). In his Table 3, for example, the values below the current value occur in 1843, 1868, 1873, 1879, 1880, 1891 (3 values), 1898, 1899, 1900, 1901 (2 values), 1903, 1905, 1906, etc. In Table 4, the same occurs in 1855 and 1872; in Table 5, in 1862 and 1932; in Table 4, all values are lower. Even in the 1945-1960 values listed in Table 7 it is difficult to justify the claim for decay. A study of, say, Table 4 (toothed wheel experimental values), extracted in Table I overleaf, shows various significant features - a decreasing uncertainty with time (and so the data cannot be treated with equal confidence), a decrease in the values of Fizeau over six years and mixed variations by others. It would be difficult to draw any reliable conclusions from this data: the means of each worker's data are erratic against time; the last result determined by each worker should be the more reliable; but this would tend to imply a growth in *c*, not a decrease!

Table I : Toothed wheel experimental data
(based on Setterfield's Table 4)

Worker	Date	Value (km/s)	Uncertainty (km/s)
Fizeau	1849.5 1849.5 1855 1855	315300 315300 305650 298000	
Cornu	1872 1874.8 1874.8 1874.8	298500 300400 299990 299900	300 300 200 200
Young	1880	301382	
Perrotin	1900.4 1900.4 1901.4 1902.4 1902.4	300032 299900 299880 299860 299901	215 80 50 80 84

Figure 1 is a plot of the data in Setterfield's Table 3. I have omitted his first two values (in 1740 and 1783) and also the error bars for convenience. A regression calculation on all the data instead of a selection gives a much smaller value for the decay of *c*. The significant point is the continuing scatter over the range of values through the hundred years. Setterfield comments (page 13) that when the data is split into fifty year segments, the mean value of c in each segment shows a trend to successively higher values further back in time. The values quoted (as differences from the current figure) are 763, 150 and 20 km /s. Aside from the scatter shown in my Figure 1, it is interesting that the latter two figures are similar to the uncertainties in the readings over these periods. The first segment represents two figures and so is not statistically significant.

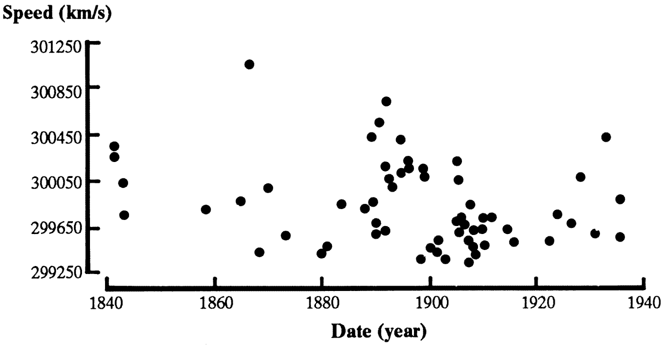


Figure 1: *Plot of the data from Setterfield's Table 3*

The point being made is that the data does not unambiguously point in one direction, even using Setterfield's selection (subjective) of the best 23 values (out of 163) in Figure II. Aardsma has replotted all Setterfield's data to show its variation from the current figure (see Figure 2).

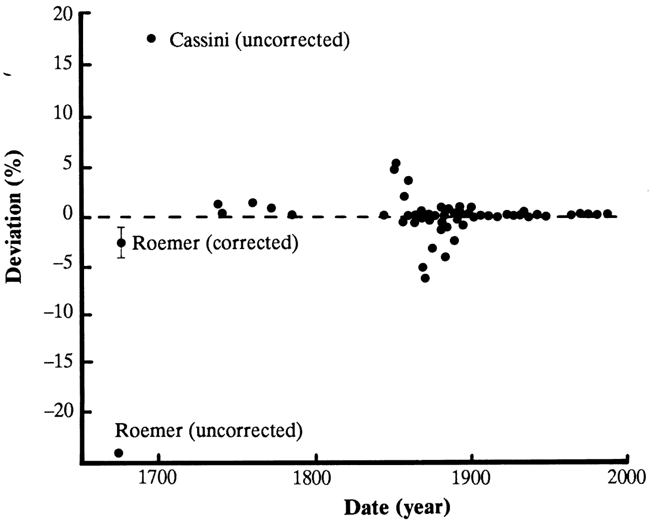


Figure 2: *after Aardsma*

It is interesting to note that most show an insignificant variation over the last 130 years. Quite a bit of the data falls below the current value, 299 792.458 6 km/ s. Even some data from 230 years ago is not significantly different from the current value. Aardsma compares Setterfield's decay of 38 ± 8 km/s/y with his own calculation of 0.0000140 ± 0.0000596 km/s/y. This is smaller than the uncertainty in the currently accepted figure and so of no statistical significance. Aardsma took into account the uncertainties in the data which makes some values less significant than others. We must also be careful in our quotations from other authors to support our case. Such quotes are usually selective, there being an equal number (or greater) authorities "on the other side." In addition, the person may be in error. For example, Setterfield quotes deBray (page 9) as saying that "**invariably**, new determinations give values which are lower than the last one obtained ..." Turning over a few pages to Table 3 (page 14), shows that statement to be clearly in error.

Seventeenth Century Data

Referring back to Figure 2 above, we must consider the points in the seventeenth century (by Roemer and Cassini). If these points are valid, then Setterfield's case becomes stronger. But how reliable are they? The earliest point (1675) refers to work by Roemer. Firstly, it must be noted that Setterfield accepted that Roemer's uncorrected figure should be amended. Unfortunately he amended it incorrectly (to 2.6% above the present figure); it should be 2.6% **below** the current value. Secondly, Cassini's 1693 value needs to be corrected in the same way. If it is not, it must be discarded. Interestingly, the effects of the two uncorrected figures cancel each other out. A reworking of the data by Setterfield's method, omitting Cassini's incorrect figure, gives a slope of -6.59 ± 0.0018 km/s/y (Humphreys). Hardly a result Setterfield would have hoped for!

Setterfield also considers a number of physically related data, such as electronic charge, Planck's constant, etc. Similar points of discussion apply to these data. But we can consider the implications of such applications of *c*.

Chronology

As mentioned earlier, a decrease in the velocity of light along the lines proposed by Setterfield would be very helpful for a "young earth" position in terms of the length of a light year in the past. However, it has other more disturbing implications! Holt has shown that, according to Setterfield's model, at 4000 BC, the length of the day would be 0.0086 seconds! Even 1000 years ago, the day would only be twelve hours long. Such deductions conflict with unambiguous historical data.

Radiometric dating techniques fare no better. Aardsma shows that the Dead Sea Scrolls (conventionally dated to 20 BC ± 200 y) have to be redated to 800 AD. It is difficult to believe that Setterfield would want to accept such a "correction." Similarly, an archaeological specimen from the time of Egyptian pharaoh Sesostris III is realigned to 600 AD. I do not know of any chronological scheme that would accept that! In fact, as the author points out, it would require every carbon atom in the wood to have been radioactive when it was growing - and then there still would not be enough Carbon-14 present to be consistent with this decay rate.

It is well known that radioactive decay generates heat. If Setterfield's work is valid, then the heat production on earth would be several million times greater in 4000 BC than at present. And the radiation level would have been lethal. Life would have been destroyed as fast as it was created.

Conclusion

Is *c* constant with time? We do not know; this data does not provide evidence in support of a decay. It may have changed smoothly; it may have changed catastrophically. Neither Setterfield not the archaeological data provide any evidence of this.

Bibliography

AARDSMA, G. E. (1988), "Has the Speed of Light Decayed?", Impact no. 179, (May).

IDEM, (1988), "Has the Speed of Light Decayed Recently?", Creation Research Society Quarterly, *25* (1), 36-40.

IDEM, (1989), "Response to Setterfield", *ibid*, *26* (1), 30.

BROWN, R. (1988), "Statistical Analysis of The Atomic Constants, Light and Time", *ibid*, *25* (2), 91-95.

IDEM, (1989), "Rejoinder to Setterfield", *ibid*, *26* (1), 32-33.

BYL, J. (1988), "On Small Curved Space Models of the Universe", *ibid*, *25* (3), 138-140.

HUMPHREYS, D. R. (1988), "Has the Speed of Light Decayed Recently?", *ibid*, *25* (1), 40-45.

IDEM, (1989), "Inadequate Defence of c-Decay Hypothesis", *ibid*, *26* (1), 30-32.

HOLT, R. D. (1988), "The Speed of Light and Pulsars", *ibid*, *25* (2), 84-88.

IDEM, (1989), "The Norman-Setterfield Model: An Inaccurate Description of Reality", *ibid*, *26* (2), 68.

SETTERFIELD, B and NORMAN, (1987), "The Atomic Constants, Light and Time", SRI International, California; August. ISBN 0 7258 0363 0

SETTERFIELD, B. (1987), "Geological Time and Scriptural Chronology", published by B Setterfield; August.

IDEM, (1989), "The Atomic Constants in the Light of Criticism", Creation Research Society Quarterly, *25* (4), 190-197.

TILLEY, P. F. (1985), "The Misuse of Correlation Coefficients", Chemistry in Britain, 162-163.

Reviews

The God who is Real
A Creationist Approach to Evangelism and Mission

by Henry Morris

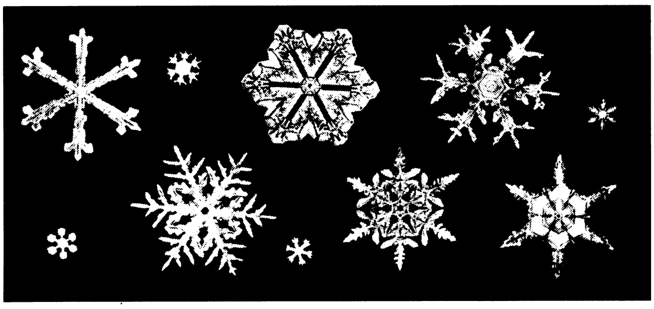
Baker Book House, Grand Rapids, Michigan, USA.
$5.95.

Reviewed by Bob Robinson

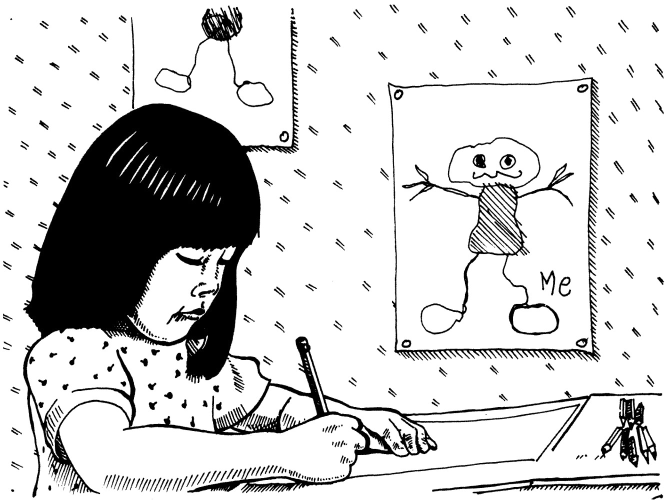
This excellent little book of some 85 pages attempts to help people understand why they should consider and then believe the gospel of Jesus Christ. It is written in an apologetic style for a secular society where the authority of the Bible has been undermined. However the book postulates that the personal God of the Scriptures is revealed in His Creation and once this is accepted, one will be more willing to examine the greater revelation of God in the Bible and in Jesus Christ.

Chapter 1 begins by proposing that there are only two basic religious systems in the world. One which believes in the personal Creator who stands above His Creation and the other which believes that the universe itself is God. This second system is the creed of evolution which dismisses the need for the "supernatural" acts of a creator God since all things can be understood by natural processes. Both systems require faith. Morris uses the designer argument and the unlikely probability of natural selection to show that it requires as great a step of faith to accept the tenets of evolution as to believe in a personal Creator. My only concern is that Dr Morris identifies all religions which deny the transcendent Creator with the terminology "evolutionary Pantheism". I believe that pantheism is the attempt of rebellious man to dismiss the Creator from his thinking. As such, evolution has lent respectability to this view, but it is not the outcome of evolution. Thus Dr Morris may have succumbed to his desire to undermine evolution and in the process lost some of the respectability and strength of his argument.

As a consequence of the growing doubt in the god "Chance", some evolutionists have begun to postulate an "intelligent universe" as stated in the Anthropic Principle, i.e. the universe revealed is the only conceivable one and it must have known we were coming. Morris argues that this view has its roots in the mystic religions of the East, which have always assumed an eternal Cosmos and denied a transcendent Creator. The evolutionists have begun to mould their views so as to conform to this pantheistic philosophy of the New Age Movement. This view requires that there is "mind" as well as matter in the universe.



The first two chapters of the book show some of the serious weaknesses with what Morris calls "evolutionary Pantheism" whereas the last three chapters present the reasonableness of believing in the living personal God of Creation as revealed in the Bible. An ordered universe in which everything is perfectly adapted is what we should expect from an omniscient Creator. Morris argues that the fossil record and the first and second laws of Thermodynamics point to an ordered Creation. He concludes that all true science supports the God of Creation.



In Chapter 4, Morris shows that the God of the Bible is consistent with His character as revealed in Creation. He uses the argument of cause and effect and Man's inherent spirituality to reveal the character of God. Morris shows that the Bible is unique in that it is the sole explanation of the actions of the Creator in Creation and in reconciling his rebellious creature, Man, to Himself. He traces the development of civilisations and the origins of Man to show that the factual evidence of archaeology fits the Biblical outline of primeval history. This argument from cause and effect has much strength and could have been extended. The Biblical view of Man as made in the image of God could have been developed looking at such things as Man's inherent morality and creativity, making him unique in Creation and inconsistent with an evolving universe.

Morris concludes his book by reminding us that the God of Creation is a God of Grace. He intervened in a world that was sick and dying as a consequence of Man's rebellion against his Creator. This is the unique message of the Bible.

This book is an ideal introduction for those who are searching for God without a Christian background. In addition, Christian students would be well advised to read this book on order to argue in a multicultural situation. I found the reasoning, both philosophical and scientific, well argued. Dr Morris has shown that he is capable of entering into the philosophical as well as scientific debate.

The Great Divide
by Gerard Berghoef and Lester Dekoster
Banner of Truth, 1989, 180pp, £2.95, paperback
Reviewed by Rev John Tindall

The method of this book is to set out the Biblical doctrine of Creation and to compare it with evolutionary attitudes to origins, especially the attitude held by theistic evolutionists. The aim of this method is to show that such a "great divide" exists between the two that it is really impossible to be true both to the scriptural doctrine and the evolutionary model at the same time. The book does not involve itself with scientific observation. Rather, it sets out the Bible's "Plan of Redemption" in Creation, the Fall and the Incarnation. In each of the three sections are a number of chapters each beginning with a brief statement of contrasting views. The rest of the chapter unfolds and seeks to establish the nature of the contrast.

The book has some strengths. It sets out very clearly how the Genesis account of Creation affects and determines the whole nature of Biblical revelation from first page to last. It shows that you cannot tamper with the foundations laid in Genesis 1 to 3 without undermining the whole of Biblical theology. There are also many helpful passages of Scriptural exposition, not least in the way the Old Testament and the New explain each other.. Time after time the inconsistency of believing Jesus but not Moses is spelled out.

One weakness consists in the difficulty of stating an opponent's view in such a way that it actually represents his position, especially when you are trying to deal with the whole spectrum of evolutionary attitudes. The authors acknowledge this difficulty in their concluding chapter. Theistic evolutionists will probably say "But I don't believe this!" However, they do not have a case to answer. Another unhelpful aspect of the work which may be personal to this reviewer, was the style of argument employed. It is combative and aggressive. For example, "The lie thus seems to provide the gullible with the advantage of having a foot in both worlds, in the safety of the Bible and the 'with it' of the evolutionary 'science'. They can be of the 'in' crowd and of the pious too; 'Christian' on Sunday, so to speak, and 'scientific' the rest of the week." While there may be some truth in this, the way it is stated is not a winning one.

I believe that the authors have succeeded in their aim and have been of considerable service to us, but they have tended to over use the hammer a little in their nutcracking zeal.

Correspondence

We have recently heard from Gerald Duffett about the ongoing Correspondence Courses on Creationism with which he is involved. We ask him to forgive our severe editing due to lack of space, but below are their overall aims.

(a) To develop a sense of wonder that God not only made everything, but He has also described in writing a summary of His works and purposes.

(b) To study devoutly what revelation states about origins.

(c) To consider 'nature' as an oft-repeated and reliable performance of an on-going yet 'finished' creation.

(d) To appreciate the timeless expression of phenomena, and sift through the rich possibilities to arrive at the basic revelation most relevant to current ideas.

(e) To receive revelation as a corrective to scientism and other human philosophies.

(f) To promote the contribution of computing to give insight about the swift acts of creation.

(g) To reflect upon the contribution of revelation to the topic of Origins.

If you would like more information please write to :

News of Creation

BCS Regional Day Conference
A Report by Charles Whitworth

The conference was held on Saturday 27 January at Hook Evangelical Church in Surbiton, two days after the violent storms of the Thursday that claimed so many lives. Some 100 members and friends attended, most from NE Surrey and the surrounding areas; one intrepid group made a day trip from Yate near Bristol.

The two main addresses in the morning session were by Nancy Darrall and David Tyler. Nancy took as her topic "Human Biology and Evolution". Taking the human eye and ear as examples, she showed the complexity of structure and function in the body. This was put forward as evidence for design, as it was viewed inconceivable that such complexity could have come about by chance successive changes over long periods of time as required by evolution. The talk, which was plentifully illustrated by slides, was concluded by looking at the evolutionary argument from homology (eg. similarity of animal limbs) and showing the weakness in that approach.

David Tyler, whose article on the New Stone Age (Origins 2:6) may be familiar to readers, gave a very thorough presentation of Stone Age and New Stone Age man within a Biblical perspective. He reminded us that the Bible knows nothing of a gradual development from very primitive to modern-day sophisticated man. It speaks rather of civilisations rising and falling from the earliest times. The traditional schoolbook approach of New Stone Age man as an ape-like savage can be shown to be a complete caricature against the evidence for a highly developed social, cultural and technological civilisation. The analysis of the sophisticated design and construction of British Megalithic sites by Professor Thom was discussed in particular and David commented on how little acceptance it had gained from archaeologists (we may wonder why).

After a rapid lunch break, which included some steady sales at the BCS bookstall, the conference divided into seminar groups. By far the most popular was the seminar led by David Tyler on the "Age of the Earth". Because of the shortage of space I could not be present, but I understand it was a lively affair which began by burning down a candle! Other seminars were "The Hidden Curriculum" dealing with the assumptions and philosophies underlying what is taught in schools and "Chemical Evolution" led by Peter Butterfield and John Peet respectively. Meanwhile, in the chapel itself the film "The Genesis Solution" was shown. Ken Ham comes across as an effective communicator, albeit at break-neck speed, with a clear grasp of how vital it is to have a right understanding of Biblical teaching on origins.

The final address was by Jonathan Stephen, pastor of Carey Baptist Church, Reading. His subject was "Genesis and Early Man" and he dealt helpfully with Biblical teaching on man between the expulsion from Eden and the catastrophic judgement of the Flood in Genesis 6. He showed how the Cainite civilisation, for all its sophistication became increasingly corrupt, and intermarriage by the originally godly line of Seth finally provoked the destruction of the world by water (Genesis 6-7).

The day finished with a useful question and answer session. Tapes of all the main talks are available from the BCS (Rugby address) priced £2.50 each including p & p. We were grateful to friends and members at Hook for their hospitality and to the speakers and seminar leaders for their contributions.

DAY CONFERENCE IN MANCHESTER

The BCS will be running a day conference at Heaton Moor Evangelical Church, Manchester, on Saturday the 13th of October, 10 00 am till 4 30 pm.
There will be three main speakers. Besides our own Sylvia Baker, we will be hosts for the day to the Back to Genesis Tour, and will be addressed by Prof. John Rendle Short, and Ken Ham.

Sylvia Baker:	Divine Design
Ken Ham:	The Questions Most Asked About Genesis - Answered
Prof. Rendle-Short:	What About Eve? – Scripture's Answer
Ken Ham:	Creationism in the U.S.A.
Prof. Rendle-Short:	Creationism in Australia & Overseas

In the evening Ken will be giving an illustrated talk on 'Australian Evidences for Creation & the Flood.' This will be more widely advertised under the auspices of the Back to Genesis Tour, and is not strictly a B.C.S. event.
Light refreshments will be available, but please bring your own lunch. Please write to PO Box 22, Rugby, CV22 7SY for more information and a map showing how to find the church.

The Fourth European Creationist Congress

Gut Holmecke, Hemer Sauerland, Fed. Rep. of Germany.
Wednesday August 22nd to Saturday August 25th 1990.

This is being organised by the German group 'Wort und Wissen', at the Gut Holmecke country house. The registration fee, which covers three nights accommodation, as well as three breakfasts, lunches and evening meals, is DM200, payable to their bank or postal account.

Bank :	Wort und Wissen Deutche Bank Hagen	Bankleitzahl (Sort Code) Konto (Account No.)	450 700 02 6922 47 99
Postal :	Wort und Wissen Dortmund	Bankleitzahl Konto	440 100 46 3406-464

Specify payment is for the 'European Creationist Congress'.

Further details can be obtained from Dr. Meskemper:
Dip. Ing. Gottfried Meskemper, Voltstrasse 26, 2800 Bremen 33, Fed. Rep. of Germany. Tel 010 49 421 2560 40

The language for the congress will be English and the chairman will be Dr. David Rosevear of the Creation Science Movement. *Participants should arrive before 5pm on the Wednesday in order to be in time for the evening meal.*

The Second International Conference on Creationism

Duquesne University, Pittsburgh, Pennsylvania, U.S.A.
Monday July 30th to Saturday August 4th 1990.

There will be four courses or 'tracks' running through the week, aimed at different needs. Thus two or more lectures may be running at the same time.

- Technical Symposium – High-level presentations. The state-of-the-art as to 'The Age of the Earth', with rebuttals and speaker responses.
- Basic Creationism – For beginners and intermediate level.
- Educational – Advice to teachers on course content and available resources.
- Evening Sessions – Challenging addresses given by notable creationist speakers.

Registration:

- Technical Symposium, Monday to Saturday inclusive, $185. (This includes the two-volume Proceedings, due to appear in January 1991). This registration also gives entry to the other 'tracks'.
- Basic Creationism or Education, Wednesday to Saturday inclusive, $95. One can attend lectures for both these, but not the Technical Symposium 'track', and Proceedings are not included.
- Evening Plenary Sessions are free.

The pre-registration deadline is July 13th, but one can attend on a daily basis. At this late date further details should be obtained directly from:

The Creation Science Fellowship, 362 Ashland Ave., Pittsburgh, PA 15228, U.S.A. Tel : 010 1 412 341 4908 or Ruth, on 010 1 412 824 3930

The Back to Genesis Tour

October 10th to 28th 1990

Ken Ham , Institute for Creation Research, California.
Professor John Rendle-Short, Creation Science Foundation, Australia.

The aim of the tour is to increase awareness of how essential Genesis is to our Gospel. The only cure for our lost state is Christ, and the cause of it was Adam. Our condition is real and not merely symbolic. As it has sure and literal eternal consequences, so must its origin have been.

Genesis contains the foundations of all our doctrine, which builds like a magnificent cathedral, to a pinnacle in Revelation. We all clearly see how 'the father of all lies' has attacked the fabric of the true Church of living stones in the past, but do we realise how much he has tunnelled into its bedrock today?

The weaknesses of roots and foundations are only brought to light by storms and upheavals, if we do not take care to look after them. Will our offspring inherit a full-orbed Gospel sturdy enough for the Last Days?

October	10th to am of 11th	Capenwray Hall.
	Evening of 11th	Leeds
	12th to 14th	Manchester
	15th to 18th	Ulster & Eire
	19th	Oxford
	20th & 21st	Cambridge
	22nd & 23rd	Swindon
	24th	Bridgwater, Somerset
	25th	Cardiff (To be confirmed)
	26th to 28th	Metropolitan Tabernacle

For more details contact Graham Scott, P.O. Box 770, Highworth, Swindon, Wilts., SN6 7TU. Please pray for the work. Any donations may be made out to B.T.G.T. 1990.

ORIGINS
• Journal of the Biblical Creation Society •

Origins is published three times a year by the
Biblical Creation Society

President	Prof. Edgar Andrews *University of London*
Vice-Presidents	Ranald Macaulay *L'Abri* The Revd Geoffrey Thomas *Aberystwyth* Prof. Verna Wright *University of Leeds* The Revd Dr N M de S Cameron *Edinburgh*

More information about the Society may be obtained from the Secretary
Biblical Creation Society PO Box 22 Rugby Warwicks CV22 7SY

Editorial matter should be addressed to The Editor PO Box 22
Rugby Warwicks CV22 7SY

Subscription enquiries should be addressed to the
Administrative Officer

PO Box 22
Rugby Warwicks CV22 7SY

Subscription Rates

Membership open to all in agreement with Aim & Doctrinal Basis of the Society.
Husband and wife for a single fee.

	Membership		Journal Only	
	Standard	Reduced	Standard	Reduced
Inland	£7.00	£3.50	£4.80	£3.50
Europe	£8.00	£4.50	£5.30	£4.00
Outside Europe (surface)	£8.00	£4.50	£5.30	£4.00
Outside Europe (airmail)	£9.50	£6.00	£7.80	£6.50

Single Issue of Journal only £1.60

Reduced rates apply to undergraduate students, missionaries, registered unemployed.

The dollar rate for those in North America (Journal Only) is
US$14 airmail
US$11 surface

ISSN 0953-2773

Printed by Inkon Printers Oldham Street Hyde Cheshire SK14 1LL Tel: 061-368 3444